MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2022/2023

BMS1024 – MANAGERIAL STATISTICS

(All sections / Groups)

4 OCTOBER 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **ELEVEN (11)** printed pages with:
   Section A: Ten (10) multiple choice questions (20%)
   Section B: Three (3) structured questions (80%)

2. Answer **ALL** questions.

3. Answer **Section A** in the multiple-choice answer sheet provided and **Section B** in the answer booklet provided.

4. Statistical tables are attached at the end of the question paper.

5. Students are allowed to use non-programmable scientific calculators with no restrictions.

SECTION A: MULTIPLE CHOICE QUESTIONS (20 MARKS)

There are TEN (10) questions in this section. Answer ALL questions on the multiple-choice answer sheet.

1. The measure of location that specifies the middle value when the data are arranged from least to greatest is the _____.
   A. outlier
   B. mean
   C. median
   D. mode

2. The costs ($) per order of items bought by a computer hardware store are provided as below. Find the mode for the cost ($) per order:

250	220	88	300	325	88	9	299	88	80

   A. $88
   B. $174.17
   C. $250
   D. $174.70

3. The difference between the first and third quartiles is referred to as the _____.
   A. standard deviation
   B. variance
   C. interquartile range
   D. mode

4. Which of the following would be an appropriate alternative hypothesis?
   A. The population proportion is less than 0.65.
   B. The sample proportion is less than 0.65.
   C. The population proportion is equal to 0.65.
   D. The sample proportion is equal to 0.65.

5. How many tissues should the package of Kleenex contain? Researchers determined that 60 tissues are the mean number of tissues used during a cold. Suppose a random sample of 101 Kleenex users yielded the following data on the number of tissues used during a cold: $\bar{x} = 88$, $s = 38$. Suppose the alternative you wanted to test was $H_1: \mu < 60$. State the correct rejection region for $\alpha = 0.05$.
   A. Reject H_0 if $t > 1.660$.
   B. Reject H_0 if $t < -1.660$.
   C. Reject H_0 if $t < -1.984$.
   D. Reject H_0 if $t < -2.626$.

Continued...

6. The head librarian at the Library of Congress has asked her assistant for an interval estimate of the mean number of books checked out each day. The assistant provides the following interval estimate: from 740 to 920 books per day. What is an appropriate, unbiased point estimate of the number of books checked out each day at the Library of Congress?
   A. 740
   B. 830
   C. 920
   D. 1660

7. Suppose a 95% confidence interval for μ turns out to be (1,000, 2,100). It is aimed to reduce the width of the confidence interval as to make useful inferences. Which of the following will result in a reduced interval width?
   A. Increase the sample size.
   B. Increase the confidence level.
   C. Increase the population mean.
   D. Increase the population median.

8. It is desired to estimate the mean total compensation of CEOs in the Service industry. Data were randomly collected from 18 CEOs and the 95% confidence interval was calculated to be ($218 126, $583 618). Which of the following interpretations is correct?
   A. 95% of the sampled total compensation values fell between $218 126 and $583 618.
   B. We are 95% confident that the mean of the sampled CEOs falls in the interval $218 126 to $583 618.
   C. In the population of Service industry CEOs, 95% of them will have total compensations that fall in the interval $218 126 to $583 618.
   D. We are 95% confident that the mean total compensation of all CEOs in the Service industry falls in the interval $218 126 to $583 618.

9. If an economist wishes to determine whether there is evidence that mean family income in a community greater than $50,000,
   A. either a one-tail or two-tail test could be used with equivalent results.
   B. a one-tail test should be utilized.
   C. a two-tail test should be utilized.
   D. None of the above.

10. If we are testing hypothesis for the difference between the means of 2 unrelated populations with samples of $n_1 = 20$ and $n_2 = 20$, What is the number degrees of freedom for the *t*-distribution test?
   A. 38
   B. 40
   C. 18
   D. 19

Continued...

SECTION B: STRUCTURED QUESTIONS (80 MARKS)

There are THREE questions in this section. Candidates MUST answer ALL THREE questions.

Question 1 (25 Marks)

How many days in advance do travelers purchase their airline tickets? Below the data showing the advance days for a sample of 12 passengers on AirAsia Airlines from Kuala Lumpur to Singapore.

11	7	4	15	29	8
7	20	9	21	15	3

(a) Calculate the mean of advance days in purchasing airline tickets and interpret your answer. **(4 marks)**

(b) Calculate the median of advance days in purchasing airline tickets and interpret your answer. **(6 marks)**

(c) Calculate the standard deviation of advance days in purchasing airline tickets. **(2 marks)**

(d) Determine the skewness of the data and interpret your answer. **(3 marks)**

(e) Construct a 99% confidence interval for the mean advance days in purchasing airline tickets and interpret your answer. **(10 marks)**

Continued...

Question 2 (25 Marks)

(a) A marketing manager would like to know if there is a significant difference in the mean of total amount spent ($) on online shopping by male and female users. He was collected responses and the data is provided as below:

	Male	Female
Sample mean	$300	$350
Sample standard deviation	$180	$100
Sample size	31	31

Test at the 0.01 significance level if there is a difference in the mean of total amount spent ($) on online shopping by male and female users.

(15 marks)

(b) Based on previous performance, 60% of Dr. Ali's students scored A in Business Statistics. A random sample of 200 Dr. Ali's students was selected and found that 125 of them scored A in Business Statistics. Is there any evidence that more than 60% of Dr. Ali's students scored A in Business Statistics at a 5% significance level?

(10 marks)

Continued...

Question 3 (30 Marks)

(a) When new home sales are strong, it has an impact on the sales of items like dishwashers, washing machines, dryers, and refrigerators. A trade association conducted a study and collected data on major appliance sales and number of housings starts. Additionally, they provided summary output to assess the relationship between these two variables:

Number of Housings Starts	Appliance Sales (RM' 000)
2000	5.0
2500	5.5
3200	6.0
3600	7.0
3300	7.2
4000	7.7
4200	8.4
4600	9.0
4800	9.7
5000	10.0

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9787
R Square	0.9579
Adjusted R Square	0.9519
Standard Error	344.8375
Observations	10

ANOVA

	df	*SS*	*MS*	*F*
Regression	1	18947609.92	18947609.92	159.3403
Residual	8	832390.0766	118912.8681	
Total	9	19780000		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	579.8709	586.0063808	0.989530037	0.355367039
Housings Starts	1.8546	0.146920508	12.62300606	4.52397E-06

Continued...

(i) State the independent and dependent variables.

(2 marks)

(ii) Determine the least square regression equation for the above relationship between the two variables. State the unit of measurement for each variable.

(4 marks)

(iii) State and interpret the coefficient of regression between the two variables.

(3 marks)

(iv) Determine and interpret the coefficient of correlation between the two variables for the above model. **(4 marks)**

(v) Estimate the sales generated if the number of housings starts at 5500. Is this estimation reliable? Explain.

(4 marks)

(vi) State and interpret the coefficient of determination.

(3 marks)

(b) The table below shows the prices and quantities of several sports' equipment used in a secondary school:

Item	2018		2021	
	Price (RM)	Quantity	Price (RM)	Quantity
Shuttlecocks	5	120	7	140
Basketball Hoop Net	30	24	32	28
Racquets	220	20	230	18
Goal posts	180	25	195	26

Determine the Laspeyres and Paasche price Index for 2021 by using 2018 as the base year.

(10 marks)

End of Questions.

A. STATISTICAL FORMULAE

A. DESCRIPTIVE STATISTICS

Mean $(\bar{x}) = \frac{\sum_{i=1}^{n} X_i}{n}$

Standard Deviation $(s) = \sqrt{\frac{\sum_{i=1}^{n} X_i^2}{n-1} - \frac{(\sum_{i=1}^{n} X_i)^2}{n(n-1)}}$

Coefficient of Variation $(CV) = \frac{\sigma}{\overline{X}} \times 100$

Pearson's Coefficient of Skewness $(S_k) = \frac{3(\overline{X} - Median)}{s}$

B. CONFIDENCE INTERVAL ESTIMATION AND SAMPLE SIZE DETERMINATION

(100 – α) % Confidence Interval for Population Mean (σ Known) = $\mu = \overline{X} \pm Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$

(100 – α)% Confidence Interval for Population Mean (σ Unknown) = $\mu = \overline{X} \pm t_{\alpha/2,n-1}\left(s/\sqrt{n}\right)$

(100 – α)% Confidence Interval for Population Proportion $= \hat{p} \pm Z_{\alpha/2}\sigma_{\hat{p}}$

Where $\sigma_{\hat{p}} = \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Sample Size Determination for Population Mean $= n \geq \left[\frac{(Z_{\alpha/2})\sigma}{E}\right]^2$

Sample Size Determination for Population Proportion $= n \geq \frac{(Z_{\alpha/2})^2\,\hat{p}(1-\hat{p})}{E^2}$

Where E = Limit of Error in Estimation

C. HYPOTHESIS TESTING

One Sample Mean Test

Standard Deviation (σ) Known	Standard Deviation (σ) Not Known
$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

One Sample Proportion Test

$$z = \frac{\hat{p} - p}{\sigma_p} \quad \text{where } \sigma_p = \sqrt{\frac{p(1-p)}{n}}$$

Two Sample Mean Test

Standard Deviation (σ) Known

$$z = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\sigma_1^2/n_1 + \sigma_2^2/n_2}}$$

Standard Deviation (σ) Not Known

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{S_p^2\left(1/n_1 + 1/n_2\right)}}$$

where $S_p^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 + n_2 - 2)}$

Two Sample Proportion Test

$$Z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad \text{where } p = \frac{X_1 + X_2}{n_1 + n_2}$$

where X_1 and X_2 are the number of successes from each population

D. REGRESSION ANALYSIS

Simple Linear Regression

Population Model: $Y = \beta_0 + \beta_1 X_1 + \varepsilon$

Sample Model: $\hat{y} = b_0 + b_1 x_1 + e$

Correlation Coefficient

$$r = \frac{\sum XY - \left[\frac{\sum X \sum Y}{n}\right]}{\sqrt{\left[\sum X^2 - \left((\sum X)^2/n\right)\right]\left[\sum Y^2 - \left((\sum Y)^2/n\right)\right]}} = \frac{COV(X,Y)}{\sigma_X \sigma_Y}$$

ANOVA Table for Regression

Source	Degrees of Freedom	Sum of Squares	Mean Squares

Regression	*1*	SSR	MSR = SSR/1
Error/Residual	$n-2$	SSE	MSE = SSE/$(n-2)$
Total	$n-1$	SST	

Test Statistic for Significance of the Predictor Variable

$t_i = \dfrac{b_i}{S_{b_i}}$ and the critical value = $\pm t_{\alpha/2,(n-p-1)}$

Where p= number of predictor

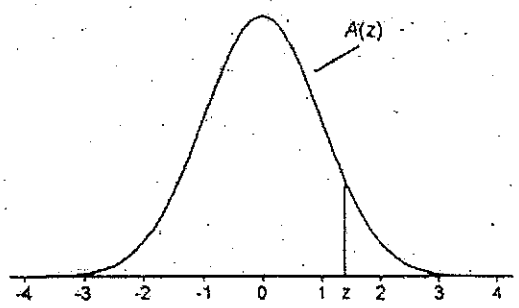
E. INDEX NUMBERS

Simple Price Index $P = \dfrac{p_t}{p_0} \times 100$	**Laspeyres Quantity Index** $P = \dfrac{\sum p_0 q_t}{\sum p_0 q_0} \times 100$
Aggregate Price Index $P = \dfrac{\sum p_t}{\sum p_0}(100)$	**Paasche Quantity Index** $P = \dfrac{\sum p_t q_t}{\sum p_t q_0} \times 100$
Laspeyres Price Index $P = \dfrac{\sum p_t q_0}{\sum p_0 q_0} \times 100$	**Fisher's Ideal Price Index** $\sqrt{(Laspeyres\ \ Price\ Index)(Paa\ sche\ Price\ Index)}$
Paasche Price Index $P = \dfrac{\sum p_t q_t}{\sum p_0 q_t} \times 100$	**Value Index** $V = \dfrac{\sum p_t q_t}{\sum p_0 q_0} \times 100$

B. STATISTICAL TABLE

TABLE A.1

Cumulative Standardized Normal Distribution



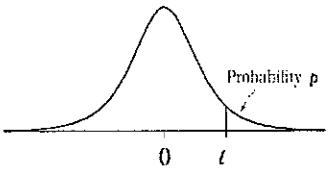
$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

TABLE B *t*-Distribution Critical Values

Table entry for p and C is the value of t^* with probability p lying above it and probability C lying between $-t^*$ and t^*.



Tail Probability p

df	.25	.20	.15	.10	.05	.025	.02	.01	.005	.0025	.001	.0005
1	1.000	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	.816	1.061	1.386	1.886	2.920	4.303	4.849	6.965	9.925	14.09	22.33	31.60
3	.765	.978	1.250	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	.741	.941	1.190	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	.727	.920	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	.718	.906	1.134	1.440	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	.711	.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	.706	.889	1.108	1.397	1.860	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	.703	.883	1.100	1.383	1.833	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	.700	.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	.697	.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	.695	.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	.694	.870	1.079	1.350	1.771	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	.692	.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	.691	.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	.690	.865	1.071	1.337	1.746	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	.689	.863	1.069	1.333	1.740	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	.688	.862	1.067	1.330	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	.688	.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	.687	.860	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	.686	.859	1.063	1.323	1.721	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	.686	.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	.685	.858	1.060	1.319	1.714	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	.685	.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	.684	.856	1.058	1.316	1.708	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	.684	.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	.684	.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.690
28	.683	.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	.683	.854	1.055	1.311	1.699	2.045	2.150	2.462	2.756	3.038	3.396	3.659
30	.683	.854	1.055	1.310	1.697	2.042	2.147	2.457	2.750	3.030	3.385	3.646
40	.681	.851	1.050	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	.679	.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	.679	.848	1.045	1.296	1.671	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	.678	.846	1.043	1.292	1.664	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	.677	.845	1.042	1.290	1.660	1.984	2.081	2.364	2.626	2.871	3.174	3.390
1000	.675	.842	1.037	1.282	1.646	1.962	2.056	2.330	2.581	2.813	3.098	3.300
∞	.674	.841	1.036	1.282	1.645	1.960	2.054	2.326	2.576	2.807	3.091	3.291

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